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ABSTRACT

A study analyzed the revision practices of 25 children in a third grade classroom, half of whom received LOGO instruction, to determine if the revision practices inherent in LOGO programing sponsor revision practices in the composing of autonomous texts of young children. It was hypothesized that the revision strategies in LOGO, both engendered and supported by the building of graphic models, would be a stepping stone between highly contextual revisions (drawing) and the more abstract revision required in writing words alone. The design of the study was three-tiered: a field experiment, a field study, and case studies. Revisions were analyzed according to observed changes in composing, features of the written products themselves, and the writers' thoughts about revision. The findings revealed an influence of LOGO revision practices in the paper-and-pencil composing behaviors of the students. The LOGO group increased its percentage of textual revisions by 20%, while the control group increased its percentage by only 8%. In addition, the frequency of rereading behaviors in the LOGO group increased more than 300%, while there was a 48% decline in the frequency of this behavior for the control group. Graphs and tables of data and a two-page list of references are included in the report. (HOD)

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The Influence of LOGO Revision Strategies On the Written Revision Practices of Young Children: A Stepping Stone

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Abstract

The Influence of LOGO Revision Strategies
on the Written Revision Practices of
Young Children: A Stepping Stone

The purpose of this study was to determine if the revision practices inherent in computer programming with LOGO sponsored revision practices in the composing of autonomous texts of young children. The underlying hypothesis is that the revision strategies in LOGO, both engendered and supported by the building of graphic models, might be a stepping stone between highly contextual revisions (drawing) and the more abstract revision required in writing words alone. To this end, the revision practices of twenty-five children in a third grade classroom, half of whom received LOGO instruction, were analyzed according to observed changes in composing, features of the written products themselves, and the writers' thoughts about revision. To amplify the primary data from the equally-matched experimental and control groups, data were also gathered from observation of the ongoing writing practices of the children in the classroom context. The findings suggest that there is an influence of LOGO revision practices in the paper-and-pencil composing behaviors of young children. The children, in three separate post-LOGO tasks, showed statistically significant increases in percentage of revision.

The Influence of LOGO Revision Strategies on the Written Revision Practices of Young Children: A Stepping Stone

While we know that children move through stages of mental development from a sensori-motor mode of thinking to mature formal operations, we are as yet unsure as how to help with this journey. How do we, as adults in teaching roles, further this process? Growing knowledge about cognitive development confirms that assistance is critical.

As exemplified in Vygotsky's concept of the zone of proximal development (1978), development takes place at two levels. The first, or actual developmental level, is the level established as the result of certain completed developmental cycles. At this level, the child can master tasks independently. The second level is the level of emerging skills or modes of thinking, not fully developed, but potentially realizable with the assistance of others. Here is where learning takes place. Children are within grasp of more abstract structures, often with culturally-embedded meanings, and, with assistance, are capable of attaining them. This assistance is the key to higher thought processes.

Yet in what form should this assistance, or instruction, take? How should it be given and in what contexts should it occur? This assistance, ever-informed by what we know about cognitive development, must be well-planned if we are to help the child move to higher developmental levels in fully meaningful ways.

Schooling, in and of itself, helps the process of reaching more abstract modes of thinking with its decontextualized activities and emphasis on verbal and logical modes of reasoning (Vygotsky, 1978; Luria, 1976, Bruner, 1971). Attention must therefore be paid to how we plan the schooling to successfully assist this process.

Margaret Donaldson (1978) brings this challenge to light when she describes changes that were made in problem-solving tasks which permitted children a further reach into abstraction. These changes proved that children were not as bound by development in reasoning as we previously thought. The problems were Piagetian tasks in which the characters and motives were altered to make "human sense" (Donaldson, p. 17) to the children. Though requiring a more formal kind of thinking, the problems dealt with factors that were within their known world. Tasks were designed to assist both the children's known understandings and potential understandings: a zone was implicitly recognized.

Schooling must be carefully designed to provide such well-planned assistance. Further, it must occur in a step-by-step manner which increasingly "disembeds" thinking, as Donaldson terms it (1978, p. 75).

In school, writing is a major tool for decontextualization (Vygotsy, 1978; Luria, 1976; Bruner, 1971; Donaldson, 1978). Written language provides the "occasion in which one must deploy language out of the immediate context of reference" (Bruner, 1971, p. 47). Children are forced to disembed through the use of written language. There is a large step into a formal system from words learned and spoken in a matrix of immediate and

meaningful events that support the utterance, to written words that require sustained thought and isolation from context. How can we assist this disembedding process? How can we help the child leave the bounds of context and cross the terrain to formal demands? Are there steps that might retain the necessary human dimension while allowing the reach for disembedded thinking?

One important aspect of writing, revision, provides a fruitful path of inquiry. Donald Graves (1979a, 1979b, 1979c, 1980, 1982, 1983) and Lucy Calkins (1978, 1979, 1980a, 1980b, 1980c, 1983), in their landmark studies of children's writing, have mapped the development of revision abilities. At the age of seven or eight, the demands of written revision seem to exceed the ability of many. Children may begin entirely new drafts, revise single words, or display a restlessness with text, with no apparent means of deliberately reformulating it. It seems difficult to shuttle mentally between intention and text, or what they are trying to say and what they are actually saying. Are they unable to do this because of the limits of their development or because of demands inherent in the medium? Could assistance be provided that would make the medium more accessible at their level of development?

Graves and Calkins both cite situational variables which assist in bringing revision into known realms for children: topic choice, emphasis on personal experiences as subjects for writing, positive and specific responses from peers and teachers, and a steady focus on the emerging meaning in a piece of writing with revision an inherent part of that search.

Another situational variable that they cite is engagement in drawing. Drawing seems to be a preamble to revision in writing. Sara, a first grader in one of Graves' studies (1983), revised block formations, furniture arrangements and drawings before revising in writing. Peter, in a Calkins study (1978), developed his story first through maps and murals. Glenda Bissex (1980) also cites, in her case study, attention to drawing. Janet Emig (1977) notes that children often draw as a rehearsal for writing.

Drawing may indeed be an important developmental precursor to writing. Vygotsky (1962) theorizes that the roots of writing are through the body into drawings. In early stages of development, gestures become writing in the air and develop into recorded gestures on paper, or drawing, and then journey to the written word.

Anne Haas Dyson (1983), in a recent study of the inter-relationships between drawing and early writing, found that for kindergarteners, a thin line exists between drawing and writing. The discursive nature of writing does not seem obvious to the children. Moreover, rather than write to communicate, they seem to overlap drawing and writing to depict entities that are more fully elaborated in talk. They seem to view writing as direct graphic symbolism in much the same way that Vygotsky hypothesized.

For children of seven or eight, Piaget (1956) posits that conceptions of space are becoming operationalized and are informing more formal thought. Do these conceptions provide support for the writing process? Particularly when, as Howard

Gardner (1980) notes, they not only have increased command of geometrical form, but may be in movement from more spatial modes of representation to a linguistic or linear mode. Could drawing then be a particularly strong support for written revision?

Seymour Papert's (1980a, 1980b, 1980c, 1980d) LOGO computer program, with its emphasis on graphics, might provide just such a stepping stone in the journey from concrete revision, or drawing, to revision in a more autonomous paper and pencil text. LOGO is an easy-to-learn language and it is used to create or build graphic models. A design, or microworld, is built by commands that direct the movement of a tiny triangular character called a "turtle." In response to commands in English, the turtle moves across the screen leaving a trail. Thus, the children, in putting the commands together like building blocks, cause the turtle to make a design. They are focused on a global intention, or meaning, and that intention is visual. They can literally see if the emerging text is matching their intention. If the text does not produce the model, they go back to the text and change it.

Revision, or debugging as it is called by Papert, is an integral and normal part of the procedure. Everything is fixable. It is simply part of the model-making, with no value judgment attached.

In line with Donaldson's view, Papert holds that the turtle is a stepping stone to more abstract reasoning: it occurs in a context that makes "human sense" to children. "In Turtle Mathland, anthropomorphic images facilitate the transfer of knowledge from a familiar setting to new contexts" (1980b,

p. 59). The LOGO program is based on a constructivist view, where knowledge is constructed by the child, and revision is an integral part of that construction. Text and graphics are interwoven in developing a desired intention. The intention is global and visualized in a gestalt. Perhaps revision practices in this model might sponsor revision practices in paper and pencil composing.

The purpose of this study was to determine if the revision practices inherent in LOGO programming do sponsor revision practices in the composing of autonomous texts of young children. The underlying hypothesis is that the revision strategies in LOGO, both engendered and supported by the building of graphic models, might be a stepping stone between highly contextual revision (drawing) and the more abstract revision required in writing words alone.

To this end, the revision practices of twenty-five children in a third grade classroom, half of whom received LOGO instruction, were analyzed according to observed changes in composing, features of written products themselves, and the writers' thoughts about revision. To amplify the primary data from the control and experimental groups, data were also gathered from observation of ongoing writing practices of the children in the classroom.

Method

Design

The design of the study was three-tiered: a field experiment, a field study, and case studies. All three were

conducted in a regular classroom setting in which I was teacher/ researcher.

In the field experiment, an experimental and a control group were established to determine whether or not a relationship existed between the independent variable (revision in LOGO) and the dependent variable (revision in paper and pencil composing). The groups were matched as closely as possible according to three criteria: (1) language scores on the Comprehensive Test of Basic Skills, (2) sex, and (3) revision maturity.

The data were obtained from the formal observation of revision behaviors during composing episodes before and after the LOGO experience. The data were also obtained from teacher intervention during two episodes, writings emanating from each episode, observation of a LOGO episode, and from interviews with each child to determine concepts of revision.

In the field study, informal observations of daily writing activities outside the experiment were kept in a log. All classroom writings were collected and reproduced for later analysis.

For the case studies, six children, three from each treatment group, were selected for further study. To ensure greater representativeness for these detailed portraits, two children were chosen from each ability level: low, middle, and high.

This multi-tiered design was developed because knowledge in the field of writing field is still fairly young. As Janet Emig suggests, ". . .early is assuredly where we are in writing research, conceptually as well as historically. . ." (1981,

p. 167). From this limited perspective we need to determine not only the particular element we're looking at but the context in which that particular element functions. The three-tiered methodology met those requirements.

Subjects and Selection of Subject Groups

The subjects in the study were the twenty-five children in my third grade classroom in a suburban public school in New Jersey. The children, for the most part, were from middle-income families, who, with the exception of two mothers, were native speakers of English. The ethnic and racial composition of the subjects consisted of sixteen Caucasian, five black, one Amer-Asian, and one Trinidadian-Indian child.

The class was a heterogeneous group. It had been constituted the year before through normal school procedures over which the receiving teacher has no influence. Present in the class were a full range of ability levels, from district-identified gifted children to children who were classified as neurologically or perceptually impaired. In addition, one child was hearing-impaired and another had cerebral palsy.

The experimental and control groups in the design were matched according to CTBS scores and sex. In turn, both groups were divided into three subgroups based on the same characteristic. Group A clustered at the ninety-sixth percentile (national percentile) and above. Group B ranged from the fifty-ninth percentile to the eighty-fourth, and Group C ranged from the first percentile to the fiftieth (see Table 1). When any disparity was present in matching scores, the edge was given to the control group to avoid bias. In addition, the number of

Table 1

Grouping for Experimental and Control Group

	Experimental (LOGO)			Control		
	Sex	CTBS National Percentile	Revision Maturity	Sex	CTBS National Percentile	Revision Maturity
A.	M	99	4R	M	99	4R
	M	96	4R	F	99	5R+
	F	96	5R+	M	96	5R+
	F	84	4R	F	91	4R
	2 M 2 F	Average %ile 93.75	17	2 M 2 F	Average %ile 96.25	18
B.	F	84	5R+	F	76	4R
	F	82	4R	F	74*	1NR
	F	71	1NR	F	68	4R
	F	59	1NR	F	66	4R
	4 F	Average %ile 74	11	4 F	Average %ile 71	13
C.	M	49*	2DR	F	50	4R
	M	39	1NR	M	50	1NR
	F	23*	1NR	M	34	4R
	M	1*	4R	M	28*	1NR
				M	5*	1NR
	3 M 1 F	Average %ile 28	8	4 M 1 F	Average %ile 33.4	11
ALL	5 M 7 F	Average %ile 65.2	36	6 M 7 F	Average %ile 66.8	42

*classified child

classified children was evenly distributed between the two groups.

Matching according to the final criteria, revision maturity, was done after the first three formal writing observations but before the experiment was begun. The behaviors observed to determine maturation were as follows:

I. Drawing Revisions

II. Random Drafting

III. Rereading Behaviors

- Word
- Phrase
- Sentence
- Text
- Previous Text

IV. Changes (deletions or additions)

- Letter
- Punctuation
- Word
- Phrase
- Sentence
- Text

V. Vocalization of Options

The behaviors recorded during the observations were placed on a revision continuum developed from Lucy Calkins description of the maturation of revision (1980a). The assignment of a stage of maturity was based on a dominance of behaviors, not in the exclusive presence of any given behavior. Each child was assigned one of seven categories of maturation as follows (see Table 1):

1 NR = No Revision

2 DR = Drawing Revision

3 RD = Random Drafting

4 R = Refining

5 R+ = Refining Plus Move Toward Transition

6 T = Transition

7 I = Interactive

Procedure

Once the selection was made, a nine week LOGO course was given to the experimental group. The control group spent this time in an unrelated unit in the science curriculum. I taught the LOGO course and my full-time teaching intern taught the science course. The courses were taught four times a week in forty-five minute sessions. The LOGO was taught in a separate room to avoid contamination of the control group. The children in each group were told that they would later take the other course. Thus, no special status was accorded to either the LOGO or the science unit. Further, the groupings for LOGO and the science units were not seen by the children as apart from the norm. Groupings of various kinds were part of daily and weekly transactions in the classroom.

During the LOGO experience, each child was formally observed once, and field notes were taken throughout. During this same period, the children in both groups were individually interviewed to determine concepts of revision. This interview was done during the normal weekly writing conference that was held with each child.

The writing conferences, during which the interviews, and the observations too, took place, lasted from eight to ten minutes. It was a time to read and discuss their work and thus questions were a natural part of the procedure. It was also a time to occasionally sit quietly by me and write while I wrote.

Writing "side by side," as one child named it, was a conference practice that I had initiated at the beginning of the year so that I could write observation notes unobtrusively while the children wrote.

Following the LOGO experience, each child in both groups was again formally observed individually during three writing episodes over a three week period. During two of the observations, I began an intervention procedure (again, not perceived by the child as anything apart from the normal conference procedure) which was comprised of increasingly directive suggestions for revision. The intervention was conducted to determine when a child perceived a need for revision in text and what role text played in fully conveying the child's intentions. The levels of intervention are characterized below on the left, with a description on the right:

Level 1	Pause	At the end of the writing task I would wait quietly for a moment to see if the child returned to the text independently.
Level 2	Query	I would then ask the child if he or she would like to look at the text again. Might it need any changes?
Level 3	Demonstration	I would next ask if the child would like me to try the task (a set of directions) before it was given to its intended audience. I would then follow the directions, explicitly demonstrating any discrepancy in the text.
Level 4	Suggestion	If the child did not return to the text, I made suggestions about how to revise the text to see if the child then returned to the text.

After the final observation, each child is again interviewed to elicit concepts of revision. The interviews, again, were part of the normal conference procedure.

Writing Tasks

The writing tasks for the six formal observations consisted both of writing of the child's choice and writings in the extensive mode which grew out of the classroom curriculum. In the pre-LOGO observations, the tasks consisted of two writings of choice and one extensive piece. In the post-LOGO sessions, they consisted of one writing of choice and two extensive pieces.

Samples of extensive writing, a mode characterized by an active role in which the writer is explaining, informing, or participating in ". . .the business of the world. . ." (Emig, 1971, p. 36), were chosen because it is a mode of discourse similar to the demands of LOGO. A LOGO text is composed to create a microworld; the extensive tasks were designed to plan or carry out a project in which the child was interested. Because the guiding purpose of this study was to determine the possible influence of "stepping stones," or gradually disembedded steps to abstraction within stages of development, the writing tasks, themselves, represented stepping stones within a context meaningful to children.

The three extensive tasks chosen for this research were structured to have some of the characteristics of LOGO. Two tasks required the children to either envision or draw a visual model and set out directions for its completion by another child on one-inch grid paper. The other task required the child to set out written directions that would enable her to navigate

through a series of obstacles in a model drawing of a favorite dragon kingdom.

The inclusion of writings of choice allowed the observation of the possible influence of choice and the possible influence of various forms of writing on revision behaviors.

The LOGO programming tasks consisted of both assigned designs and designs of choice. The assigned tasks always arose out of an interest the children had, as did the extensive writing tasks. The designs were constructed through a sequence of single commands, each reflected by the turtle's movement on the monitor screen. The sum of these commands, and thus the turtle's movements, created a design.

Analysis

The data gathered from the three formal observations of the pre-LOGO writing episodes, the single LOGO episode, the three post-LOGO episodes, and the resulting writings were analyzed for the purpose of developing a generalizable unit which would permit the measure of any increase in revision behaviors.

The resulting profile revealed that most of the changes, for children in all three ability groupings, were word-bound changes (letter formation, spelling, and punctuation). The number of changes beyond the word (phrase, sentence, or sentence group) was very small. Thus, the unit for measuring change became the numerical value of the ratio between the number of word changes and the total words in the text.

Once the unit had been defined, it was possible to derive a

mean score for the experimental group and for the control group in each observation. To determine if the difference between the two groups was statistically significant, a t-Test was performed for significance of difference between the means on the three post-LOGO episodes.

The experimental data was then examined using other analytical tools for determining revision behavior. First, each change was identified either as a change in surface features (changes in handwriting, spelling, or punctuation that did not change the meaning of the text or any portion of it) or a change in text (punctuation, word, phrase, or sentence group which in any way altered the previous meaning). Changes in text revisions were particularly noted as they represent a more mature category.

Second, the data was examined for rereading behaviors. During the observations, the number of times a student reread was noted. Though rereading is not revision per se, it is a behavior that can be regarded as a precursor to revision. Rereading is a "looking again" at the text. It is a consideration or reconsideration that precipitates change.

Third, the data was examined for responses to the intervention procedure. The level of independence at which the child returned to the text was analyzed. Interview statements were also analyzed and the statements of each child were classified along the revision continuum to determine any change in conceptions of revision.

In each of these four categories, the numbers were too small to be statistically significant, however, the data was organized by treatment group to present a comparison between

the two.

Turning to the data from the field study (the field log and the writings that were not part of the experiment), I again looked for changes in the categories of surface and text revision, rereadings, and responses to the various teacher interventions. The evidence that was being sought was that which would confirm or deny the patterns that were developing in the experimental data. I also recast the data to examine whether or not the variable of sex, ability group, or forms of writing were influencing change.

In the case studies, each pair of children, from the three ability levels, was studied. The children from the treatment groups were paired because the analysis and description of each child, as detailed as it would be, might be more revealing when also compared to a child with similar abilities.

School and family histories were carefully gathered for each child and examined for information that yielded insights about the child's school interactions and in particular, writing and drawing behaviors. The child's behaviors were then examined, in order of occurrence, through the various data sources: the formal observation records in their entirety which included a transcription of what the child had written punctuated with recorded movements, pauses, vocalizations; remarks; writings; field notes; interventions; and interviews.

Results and Discussion

The findings suggest that there is indeed an influence of LOGO revision practices on the paper and pencil revision behaviors

of young children. The children in the experimental group, over three separate post-LOGO episodes, showed significant increases in the percentage of over-all revision behaviors. Figures 1 to 3 graphically display the differences in the percentage of revision between the groups for each post-LOGO task. The percentage of each child is shown in an array ranging from the child performing at the first percentile level according to CTBS score to the children performing at the ninety-ninth percentile.

As can be seen in Table 2, the difference in the means is statistically significant at $p<.05$ for Task E and statistically significant at $p<.01$ for Tasks F and G.

While the size of the sampling in the other revision categories prevents a statistically significant finding, the magnitude of change found in each suggests that further study is merited. In two major categories of revision, text change and rereading behaviors, the experimental group demonstrated markedly higher increases. The LOGO group increased its percentage of textual revisions by twenty percent. The control group increased its percentage by only eight percent. The frequency of rereading behaviors in the LOGO group increased more than three hundred percent. For the control group there was a forty-eight percent decline in the frequency of this behavior. The sharp contrast between the groups in both textual and rereading behaviors is of particular interest since text revisions comprised 91 percent of the revision behaviors in LOGO composing, and, too, a primary characteristic of the children's composing was a continual shift in gaze between text and graphics:

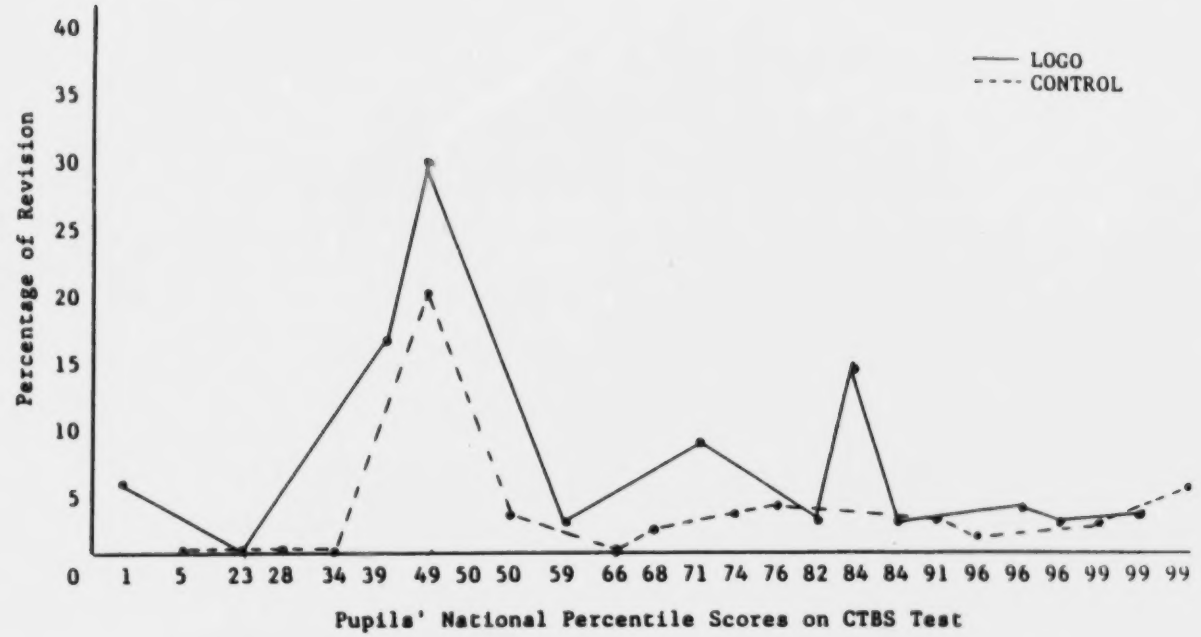

Figure 1. The difference in percentages of revision between pupils in the LOGO group and pupils in the control group in post-LOGO Task E (Dragon Grid)

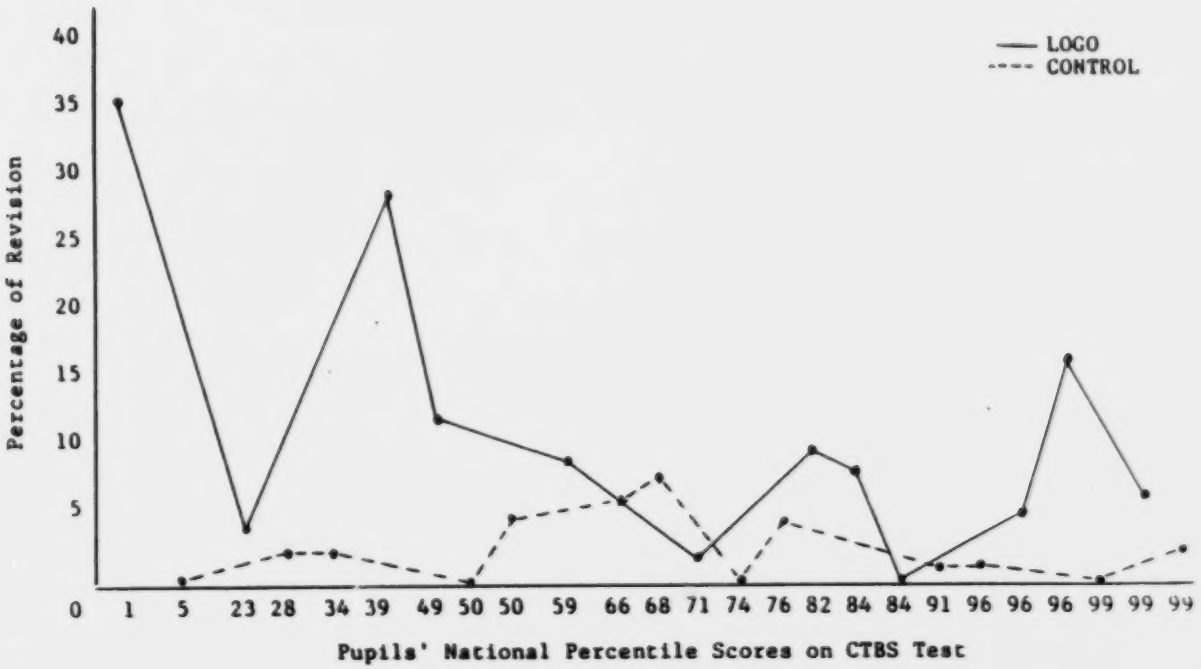

Figure 2. The difference in percentages of revision between pupils in the LOGO group and pupils in the control group in post-LOGO Task F (Grid Choice)

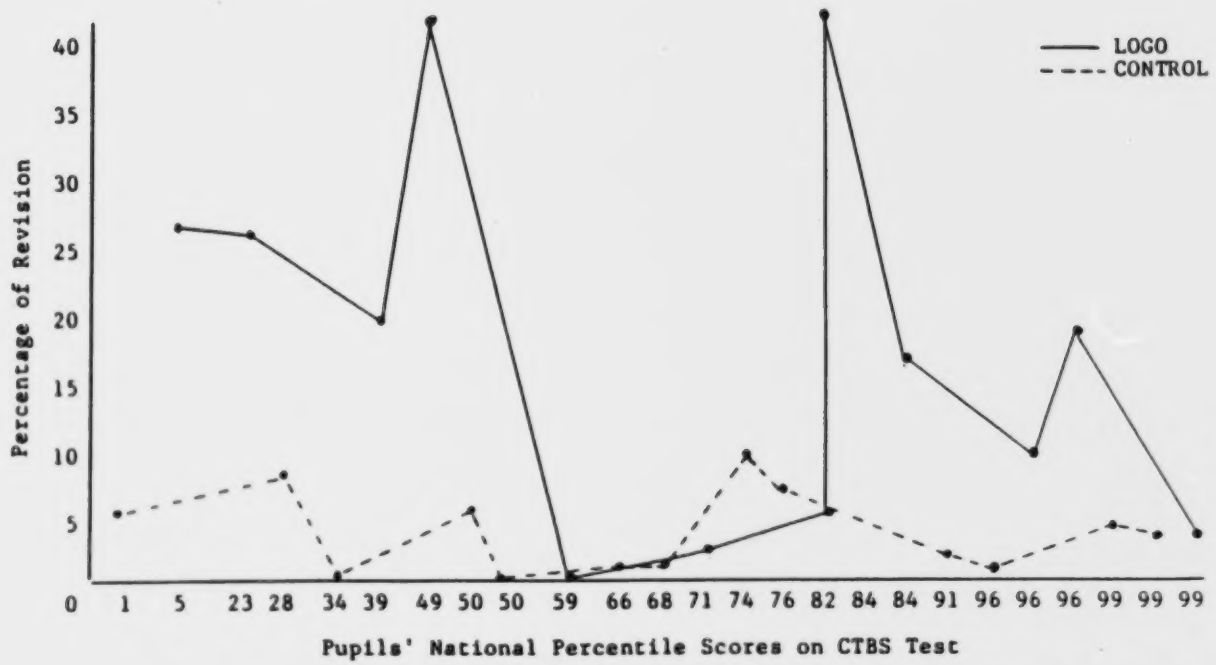

Figure 3. The difference in percentages of revision between pupils in the LOGO group and pupils in the control group in post-LOGO Task G (Writing Choice)

Table 2

T-Test for Significance of the Difference Between the Means on Post-LOGO Writing Tasks

Task E

Groups	N	$\bar{X}$	SD	Range	df	t
LOGO	12	10	8.29	0-30	23	2.3*
Control	13	4	5.28	0-20		

Task F

Groups	N	$\bar{X}$	SD	Range	df	t
LOGO	12	13	13.77	2-41	23	2.9**
Control	13	2	2.65	0-8		

Task G

Groups	N	$\bar{X}$	SD	Range	df	t
LOGO	12	20	20.45	0-69	23	2.9**
Control	13	4	3.23	0-9		

*p<.05
**p<.01

a kind of rereading.

In response to the teacher interventions, the children in the LOGO group, in a ratio of two to one, returned to the text independently during the composing episode. Ten of that group returned with no external prompting and eight of them proceeded to revise. In the control group, only six reread independently and only three then revised.

At level three of the teacher intervention procedure, where I demonstrated a discrepancy between their text and their intention, eleven of the LOGO group revised, and only eight of the control group revised. Further, ten in the control group needed explicit suggestions about returning to text to revise (level four), whereas only five in the LOGO group did.

In the non-experimental classroom writings, I found that there were more text revisions in both groups than I had found in the formal observations. The text revisions were primarily word-bound, but there were changes in story endings. The changes were more frequent in the LOGO group, but because these writings emerged out of a highly interactive environment where children continually sought and received responses to their work, the evidence is inconclusive.

In the interviews conducted in December and again in February, the definitions of revision in both groups reflect a movement toward broader conceptualization of change. While all children at the upper ability level elaborated more fully about revision involving a change of ideas, four of them (three in the control group) were verbalizing what was not yet practiced in their own writing. Several of the children from the lower

ability experimental subgroup, though unable to be explicit about what rewriting was, were, in contrast to those in the similar control subgroup, making large numbers of changes in their writing. A significant portion of these revisions was textual.

The sampling of explicit responses was too small to show a conclusive trend, within groups, along the revision continuum. There was, however, greater mention by those in the experimental group of changing ideas in text (". . .you might get new ideas for a whole new story. . ."), of experimentation (". . .you experiment. . .which idea sounds better. . ."), and a sense of the meaning in text as a vehicle for interacting with a reader ("You change it [the story] and it might be more interesting to people."). Text was a weightier vehicle for carrying meaning.

As I looked at the possible effect of sex, ability level, or forms of writing, it became apparent that the size and composition of each subgroup make it impossible to control for the influence of any one of these variables. While any one of these variables may have had an effect, the nature and magnitude of any such effect could not be identified.

The case studies, too lengthy to be fully discussed in this paper, mirror the findings for the groups. The LOGO children in the case studies demonstrated not only more revisions, but many more returns to the text for rereading or vocalized reconsidering. The vocalizations range from low semantic comment when they were considering change ("hmmm, now let's see"), to full remarks ("Oh, rats. I mean Dad, I'll change it to Dad."). They returned to the text more readily and seemed

to have a strong sense that since text conveys meaning, revision was required if meaning was to be changed.

The revision behaviors, while dramatically increasing in number and occurring more readily in the experimental group, did not change in kind. The lower ability group did make significant moves into the arena of textual revision (word-bound), but over-all there were no major leaps on the continuum into the most mature stage of interactive behavior where changes in text resulted in changes in story subject, voice or tone. The children in the experimental group did indicate shifts in perspective that comprise what Calkins (1980a) calls mature interactive behavior. While they were able to look at, as evidenced in rereading and vocalizing behaviors, their text in light of those intentions, the changes were still primarily word- and phrase-bound.

There can be, of course, several reasons for the lack of more mature interactive revisions. First, the study was of short duration. Even in a classroom environment where instruction makes change the norm, normal cognitive growth must be seen as a full partner in the development of children. This development takes time. Second, the children were observed for short periods of time (an average of eight to ten minutes per episode), and starting and stopping so quickly is disadvantageous to lengthy and probably more major considerations of the text. Third, there may have been present, as Graves (1979c) and Calkins (1983) have both cited, a plateau for this age level where they seem more rule-bound and thus more attentive to surface features, even though they are displaying potential for larger kinds of

textual revisions. My findings confirmed Graves' observation (1979c) that even children (a) who had moved beyond the need for concentrated effort on spelling and punctuation and (b) for whom writing generally came easily, still revised in no major way. They did make text revisions, but the revisions were more concerned with detail.

Yet, while there seemed to be few acquisitions of the most mature kinds of revision behavior, the increase in the instances of revision strongly suggests that important shifts were occurring and that they were occurring at all ability levels.

The children in the experimental groups seemed to have a more fluid relationship with their texts. They not only returned to the text for meaning more often, but also seemed to regard it as mutable. They looked at their intentions, looked at the text, and changed it more often to match their intentions. Even those children with less ability regarded the text as a carrier of meaning and returned to it more often. Whether it was a restlessness that was pre-articulate, or a more conscious weighing of options, the concept of revision seemed to be operative and more fully formed in the children from the experimental group. Calkins (1983), in her study of Susie, speaks not only of the visible plateau, but of growth that may be occurring underground. Though concepts in a given domain may not appear to be increasing in number, the existing ones may be expanding in range and sophistication.

Implications for Instruction

The evidence suggests that LOGO can be an important tool in sponsoring the paper and pencil revisions of young children

for whom drawing is still an important mode of representation. At an age where expression in spatial terms is moving toward a new and powerful verbal mode, LOGO provides strong focal, meaningful wholes to explore through text. The LOGO tasks provide a point of engagement with more abstract worlds. Children actually see their intentions and, as they work to meet them through text, learn revision in the most fundamental way. As they pursue meaning through language, they revise meaning.

LOGO programming is a kind of extensive writing that is both personal and meaningful. Just as LOGO provides this meaningful writing, so too can other kinds of extensive writing and writing/drawings be created so that children can transact in similar ways with experiences in the world. Writings that assist in solving problems or that realize intentions other than the writing, itself, need to be explored. The writing helps to achieve meaning and it is revised as the child works to ensure the desired meaning. As stated before, the most fundamental kind of revision is addressed.

Implications for Research

There are, of course, limits in any study with only twenty-five children. However, evidence of significant growth in revision behaviors in this population suggests the need for further studies. These studies should take place in classrooms where LOGO is introduced on an experimental basis in a regular classroom context.

Although the study was of a short duration to minimize the influence of the variable of development, a study over a

long period of time, perhaps two years with second or third graders, would yield valuable information on the influence of LOGO on the composing practices of young children. Further, studies that explore the influence of extensive writings, drawings, and writing/drawings on revision are strongly suggested by the evidence.

There are, too, the limits of the role of teacher as observer and the inevitable limits of a field experiment, where many variables from the context cannot be controlled. Yet the richness of context adds immeasurably to what we are beginning to know about children learning in the classroom environment. If schooling is indeed critical for the development of higher thought processes, and language an important tool in schooling, then both must be studied in the context where they occur. With further language studies in school contexts, we will learn more about the relationships between modes of composing and the revision strategies within. We will learn more about the relationship between different stages of revision development. We can then become better informed about the stepping stones that teachers can provide between the concrete and the formal in mental development.

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